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# CAPACITIVE SENSORSWITCHES

*White paper*

## Capacitive sensor technology for high-tech on rails - used in the world's most modern trains

From Hong Kong via Shanghai and Nanjing to Beijing and  
further - a route of superlatives

**CAPTRON**

# Maximum quality and modularity

China Railways' 380-series high speed trains relies on capacitive SENSORswitch from CAPTRON.

## A customized project

**The product requirements in traffic technology call for the newest technological innovations - in the field of sensor technology are maximum performance and individuality of utmost demand.**

The robust SENSORswitches from CAPTRON offer maximum service life and easy use - fulfilling highest standards. However, the challenge lies increasingly in the heterogeneity. More and more projects require products beyond the standard norm.

For SENSORswitch in exceptional environments are specific, project-based features necessary. Sensors with exclusive properties such as extremely thin designs and uncomplicated assembly move into focus. Maximum reliability plus product-specific advancements is the métier of CAPTRON. Best example: the development, production and project management of several thousand SENSORswitches for one of the most modern rail lines worldwide - the CRH 380 series - China's prestigious high-speed trains.

## Highspeed like a rocket

The world's fastest serial produced trains, 11,800 horsepower, top speeds of up to 480 km/h, up to 16 railcars for 500 passengers simultaneously - China's high-speed train lines up the superlatives like a string of pearls. Every detail of this exclusive infrastructure project

is proof of high-tech on rails; from vehicle engineering to the integrated sensor technology from CAPTRON. A technology which was specially modified for this train application to open the railcar doors selectively and provide the China South Railway Cooperation, its passengers and crew with maximum safety, reliability and highest comfort.

This project-related advancement from serial models to customized SENSORswitches is exemplary of CAPTRON's philosophy. For even the standard capacitive SENSORswitch models are unique, thanks to their special product features.

The modification of the sensor range for the high-speed trains further expands this competence. The aim was to combine the essential requirements of SENSORswitches in traffic technology with application-specific features.

*„Our customers demand absolute product reliability, no matter where and under what conditions. That is why the modification of our production models, based on explicit customer requirements, is also an important service of our company.“*

(Philip Bellm, Head of Marketing & Sales CAPTRON Electronic GmbH)

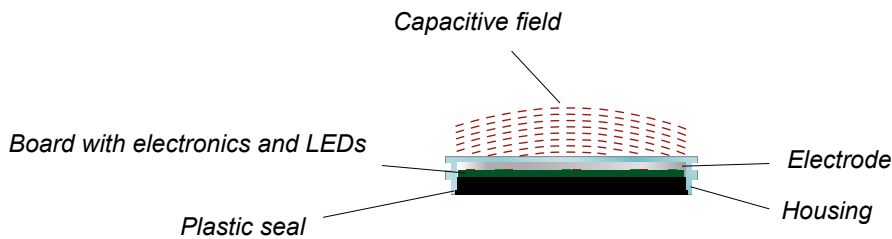


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**A technology with economic competence**

CAPTRON focuses on the capacitive principle - for a good reason. The in-house developed, high-quality SENSORswitches are activated without applying pressure. A simple touch by hand or other body parts is fully sufficient. A capacitive sensor measures the capacity between the sensor surface and the sensor environment. When a passenger's hand approaches the sensor, the capacity increases and the capacitive field is changed. If the measured change in capacity is large enough, the integrated software generates the corresponding switch

resin, and the weather-resistant housing made of polycarbonate material, protects the electronics against dirt, moisture and external forces. Also the edgeless design prevents dirt from settling. In addition, the highest possible density-protection class permits high-pressure, hot water cleansing at close range. Important aspects for a prolonged service life. Considering that rail cars are durable and capital-intensive products, technology used then should also comply with the highest standards for durability and quality.



ching operation. This non-contact switching process offers huge advantages, which are also brought to bear in this high-speed train case. First, the maximum reliability. Since the switch requires no mechanical movement, there is zero wear.

Known mechanical problems such as jamming or locking the switch no longer exist. Thus, repairs and additional maintenance expenses are a thing of the past. At the same time, the life span is profiting from this purely electronic function. With several 100 million operating cycles reaches the SENSORswitch the hundredfold number of a normal mechanical switch and is thus ideal for highly-frequented, long-term day-to-day operations on trains. The electronics, encapsulated with special waterproof



**TRAFFIC & TRANSPORT**

CAPTRON has been specialised in the application and distribution of capacitive sensor technology from the very beginning. During its first successful years, the company focused on further developing the relevant technology, which, in 1994, was first applied in the form of a SENSORswitch in transport engineering.

Learn more at: [www.captron.com/en/industries](http://www.captron.com/en/industries)



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**A product which saves time and money**

An additional argument for selecting the CAPTRON *SENSORswitch* in CRH (China Railway High-Speed) trains was the installation. A product feature receiving little credit often, but whose technical and financial importance is rather significant. In case of the *SENSORswitch* in absolutely positive terms, because the switches are quickly and easily 'glued.'

High-strength industrial adhesive tape allows the uncomplicated adhesive mounting. An optimal solution. The rear mounting ring is fitted with an all-surface adhesive tape - clean disc, remove foil, position switch, press down, finished! Even preparing the surface with a primer becomes obsolete. After the fixing ring is mounted on the disc, the sensor element is clipped into the ring - fast and easily. The sensor element can also be easily removed again at any time. Drilling holes incl. bolting for

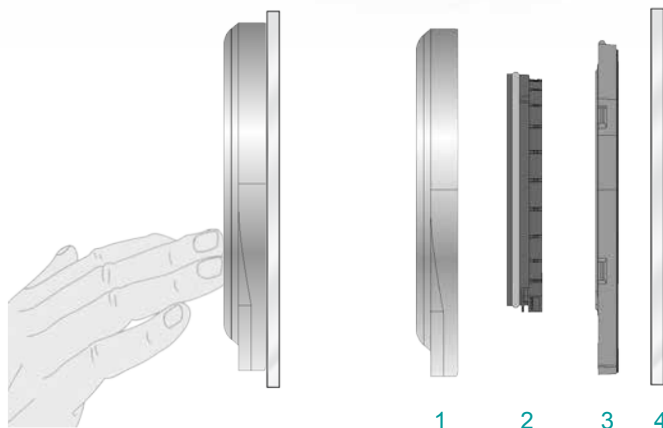
fastening the switches are in the case of the *SENSORswitches* no longer an issue. Cover, body, disc etc. remain undamaged.

Only an opening in the door frame is necessary for the cabling. CAPTRON has over 20 years experience with this bonding process - with great success. Easy, fast and cost-effective. Each switch is a profit. The surface area does not matter.

Whether wall, door or glass installation, these switches can be flexibly mounted thanks to their construction. In the case of the high-speed trains, the *SENSORswitches* were clipped onto previously glued fastening rings behind the glass pane of the door leaf respectively the window - a particularly easy installation. The connection is made via a plug directly on the side of the switch.



*SENSORswitch* CHT74-2 (metal)



- 1 Coloured cover ring
- 2 Sensor with O-ring
- 3 Mounting flange with adhesive tape
- 4 Glass-, acrylic- or metalplate

## A switch for the everyday train traffic

The status feedback of the switching process occurs optically via 16 LEDs – respectively eight green and red ones. These illuminate clearly visible, according to the given situation (switched / not switched).

The sensor series also offers a tactile feedback by means of vibration. But also special symbols stood on the customer's wish list. Of course the user interface is also intuitively usable and absolutely user-friendly.

According to the technical specifications for persons with reduced mobility, the switch is also TSI-PRM compliant. The key row is fitted with a 25 cm<sup>2</sup> touch screen surface for maximum convenience. A gladly-seen product highlight - the extreme robustness. The resilience of the switches has been tested under extreme conditions for all eventualities. The result: The CAPTRON SENSORswitch was not impaired in its function. Problems with vandalism can be shelved.

## A project with special features

Even if the attribute „capacitive“ per se refers to the nifty contact-free use, CAPTRON's philosophy also includes the finesse of design. Elegant, timeless and in harmony with the environment. Matching the futuristic appearance of highspeed trains with their aerodynamic locomotives, a high-quality metallic look (titanium silver lacquered) was selected for the switch casing.

Another special feature: the switch height. In view of the thin railcar door frames, the switches had also to be kept at a minimum height. A special product adaptation was realized here as well. Parallel to this application, an additional custom-fabrication assured the clean installation. Thanks to pre-cut recesses in the aluminum frame, the switches could easily adapt to the prevailing installation conditions onsite.

Dedicated experimentation in the field of sensor technology defines the work of CAPTRON's engineers and technicians for over 30 years. This passion for detail is found in each of the hand-crafted sensors from the Bavarian enterprise.

Another strong feature is CAPTRON's DIN 50155 certification for railway applications. Because components, that are used in the railway industry must meet extremely high requirements and be absolutely reliable with respect to environmental impacts. „Our customers demand absolute product reliability, no matter where and under what conditions. That is why the modification of our production models, based on explicit customer requirements, is also an important service of our company,“ confirms Philip Bellm, Head of Marketing & Sales, CAPTRON Electronic GmbH, the firm's philosophy.



Application images CAPTRON

## One project, one requirements catalogue, one result

A project which started with the product series CHT7, and through the specific requirements of the China Railway High-Speed trains, leading to the newly engineered CHT74-2 switch: The height was minimized to suit the thin railcar door frame, the installation was enormously simplified through individual recesses in the aluminum frame, special symbols increased the communication security and also the design was adapted to the futuristic environment.

**In short: The project of the Chinese high-speed trains allowed no standard product, but a high-quality SENSORswitch, modified around elementary details for smooth services in everyday railway operations.**

From the initial product inquiry to the final installation of the capacitive SENSORswitch, it took less than a half year - product selection, customized adaptations, consulting, production, delivery and installation - everything went smoothly and in close contact. Thanks to the CAPTRON branch office in China, a constructive and very detail-oriented product development was possible. The result: Thousands of customized switches from CAPTRON ride on the fastest trains in the world.

- Adhesive mounting  
No screws required.
- Touch Control  
High ease of use, no mechanical pressure required.
- One-sided control  
Can be used on the inside only.
- Feedback  
Visual and tactile signals through 16 LEDs and vibration.
- Shock-resistant  
The sensor cannot be destroyed by lighter flames or severe blows.
- 100 % water & oil-proof - IP69K  
Sensor completely sealed in cast resin.
- Durable service life  
More than 100 million operation cycles (transistor output).
- Accessibility  
Braille and raised chevrons on coloured cover ring, 25 cm<sup>2</sup> operating surface.
- TSI-PRM certified (depends on model)  
By directive 2008/164/EG.

## ABOUT CAPTRON

CAPTRON Electronic has been manufacturing electronic capacitive sensors in German production for over 30 years. CAPTRON focused on the requirements and application in the automation, traffic and transport and building technology sectors.

Based on the same operating principle as capacitive sensors, SENSORswitches, fluid sensors and the „safeCAP“ safety technology form part of the product range of the sensor manufacturer. Furthermore, CAPTRON develops and successfully produces LED signaling technology and optical sensors. The development of innovative solutions is an additional strength of CAPTRON.

When it comes to customers' special solutions and requirements, CAPTRON can at all times be relied upon as a competent partner. Together with its customers, CAPTRON designs and develops special sensors and customised products for individual application. All products are impressive with a maximum on functionality, longevity and precision.

Follow the link for more information: [www.captron.com](http://www.captron.com)



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